Vibration Perception Threshold in the Screening of Sensorimotor Distal Symmetric Polyneuropathy: The Need of More Accurate Age-Specific Reference Values

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Use of the vibration perception threshold (VPT) is a simple way of detecting large-fiber dysfunction, thus identifying individuals with diabetes at risk of ulceration.1,2 Nevertheless, poor standardization of measurement limits its use in clinical practice;3,5 Furthermore, the unique normality threshold of 25 V is criticized due to the physiologic increase in VPT with age.6 The development of devices reducing the intra- and interoperator variability in the test execution could help research and clinical practice in the identification of new relevant reference thresholds. In this context the UltraBiotesiometer Meteda contains specific features that reduce the variability of the measurements, that is, the vibration activated only under controlled pressure, five indicator lights allowing the monitoring of the pressure, and the elasticity of vibration electrically controlled in both directions. We adopted this new technologically advanced biothesiometer to assess VPT trends in subjects without sensorimotor distal symmetric polyneuropathy and identify age-specific normality thresholds.

A random sample of 150 consecutive individuals have been identified among those routinely referred to one endocrinology center in Argentina. Patients were considered eligible for the study if diabetes, neuropathy, and slipped disc were excluded. Recruitment was stratified according to three age classes: <45, 45-60, >60 years. VPT was measured using UltraBiotesiometer Meteda.

Normal ranges for VPT were computed using the normal approximation. The upper limit of this range was reported along with its 95% confidence intervals. Subjects with values larger than the estimated upper limit should be considered as “nonnormal.” Subgroup analyses for each age class were performed. VPT values were log-transformed before analyses because their skewed distribution. A P value < .05 was considered significant. All analyses were performed using R software.

Table 1. Upper Limits of Normal Range Above Which the Subject Should Be Considered as “Nonnormal” Overall and According to Age Classes.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Upper limit</th>
<th>95% confidence intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>20.9</td>
<td>18.6, 23.5</td>
</tr>
<tr>
<td>20-45 years</td>
<td>16.6</td>
<td>13.7, 20.1</td>
</tr>
<tr>
<td>45-60 years</td>
<td>19.4</td>
<td>16.0, 23.4</td>
</tr>
<tr>
<td>60-77 years</td>
<td>24.3</td>
<td>20.0, 29.7</td>
</tr>
</tbody>
</table>

Our results document that normality threshold in the overall population is lower (20 V) than that currently suggested by guidelines (25 V) and relevant differences in VPT upper limits exist according to age classes (Table 1). The normality thresholds identified cannot provide direct indications for changing clinical practice, but the clear trend and the marked differences among the upper limits in the three age classes cannot be ignored. Further longitudinal studies adopting technologically advanced devices are needed to assess the association between age-specific normality thresholds and incidence of lower limb complications.
**Abbreviations**

DPN, distal symmetric polyneuropathy; V, volts; VPT, vibration perception threshold.

**Declaration of Conflicting Interests**

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: GV is a medical consultant for Meteda srl and the inventor of UltraBioticsometer, San Benedetto del Tronto, Italy.

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**References**